The use of telephone interview methodology to obtain 24-hour dietary recalls

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ABSTRACT

Objective To compare 24-hour dietary recalls collected over the telephone to in-person recalls collected in the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII).

Design Trained interviewers collected 24-hour dietary recalls over the telephone using the multiple-pass approach. These results were compared to in-person interviews from a pooled subsample of CSFII respondents.

Subjects/setting List-assisted random-digit dialing was used to identify 700 women between the ages of 20 and 49 years. One eligible woman per household was selected to participate.

Statistical analyses Approximate *t* tests to examine differences in average nutrient and energy intakes were conducted on weighted data.

Results The reported intakes of most nutrients in the current 24-hour dietary recalls collected over the telephone were significantly higher than those reported in the 1994 and 1995 CSFII, but there were no significant differences between the telephone survey and 1996 CSFII results. The 24-hour dietary recalls collected over the telephone yielded consistently greater mean nutrient intake per respondent compared with a comparable pooled subsample from the 1994, 1995, and 1996 CSFII. Generally, no significant differences were found in the food group data between the telephone survey and the CSFII survey. Mean dietary intakes reported by the comparable CSFII subsample increased from 1994 to 1996.

Applications Collecting 24-hour dietary recalls over the telephone is a practical and valid data collection tool for use in national food consumption surveys. *J Am Diet Assoc. 1999;99:1406-1411.*

Information on dietary intake is an important aspect of many national epidemiologic studies. Dietary intake data are used to establish food and nutrition policy, track progress toward achieving health and nutrition objectives, and provide valuable information in the development of nutrition and health intervention strategies (1-3). The 24-hour dietary recall is the primary method used in most large-scale national nutrition surveys, such as the Continuing Survey of Food Intakes by Individuals (CSFII) and the National Health and Nutrition Examination Survey (1,3,4).

A 24-hour dietary recall is relatively easy to administer and useful for assessing average usual intakes of a large population (5). However, surveys that collect 24-hour dietary recalls in face-to-face interviews are costly (6). One way to reduce costs is to substitute face-to-face interviews with telephone interviews. Whereas previous studies have compared various methods of obtaining health-related data (7-11), and several small-scale studies have tested the validity of the telephone-administered dietary survey (6,12-16), to our knowledge no large-scale studies have yet been reported. Posner et al (6,17) tested the feasibility and validity of a telephone-administered 24-hour dietary recall using a 2-dimensional visual guide for estimating food portion sizes. Fox et al (18) reviewed telephone surveys as a method for obtaining dietary information and stressed the need for further research on the validity and reliability of the methods, because the use of telephone surveys for this purpose is gaining popularity. In general, most such research has involved relatively small samples and used varying methods of collecting dietary intake data.

In 1965, the US Department of Agriculture (USDA) first used the 24-hour recall in a national survey (19). In 1985, CSFII, a continuing nationwide food consumption survey, was conducted by the USDA's Agricultural Research Service (20). The most recent CSFII was conducted from 1994 to 1996 and was known as the "What We Eat In America" survey (3). The

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1994-1996 CSFII was specifically designed so that results of the survey could be reported by individual year or by the 3 years combined. Most interviews associated with these surveys were conducted in person. Although some 24-hour dietary recalls were conducted by telephone during the 1985-1986 CSFII, the initial household contact and the first 24-hour dietary recall for each respondent were conducted in person. In the 1989-1991 CSFII, interviewers collected 24-hour dietary recalls from respondents and trained the respondents to keep 2-day dietary intake records (21). The interviewers believed the recordkeeping was too burdensome and difficult for respondents. Underreporting, which has been a concern in 24-hour dietary recalls (3), was another issue addressed in the development process for the 1994-1996 CSFII. To address these issues, the dietary data collection method chosen for the 1994-1996 CSFII was 2 interviewer-administered 24-hour dietary recalls using a multiple-pass approach (22,23). The exclusive use of 24-hour dietary recalls eliminated the burden of recordkeeping for the respondent, and the multiple-pass approach was designed to reduce underreporting.

In preparation for the 1999-2002 CSFII, the USDA considered the use of a telephone survey because it would be less costly than collecting data in person. Therefore, this study was designed to evaluate the feasibility of collecting 24-hour dietary recall over the telephone and to compare the nutrient intakes from 24-hour recalls collected over the telephone with those collected through the in-person interviews conducted for the 1994-1996 CSFII.

METHODS

Sample

Women aged 20 to 49 years were chosen for the telephone survey because they were expected to be knowledgeable about the preparation of foods they consumed. The study population was limited to one sex/age group to ensure a sample size large enough for comparison with the CSFII. Data were collected from January through March 1998. For the benefit of comparability, the CSFII sample was restricted to female respondents who were 20 to 49 years old at the time of interview and who recorded their intake during the months of January, February, or March (ie, roughly the period of data collection for the study).

A target sample size of 700 respondents was chosen because it is large enough to detect a difference as small as approximately 100 to 150 kcal with a significance level of .05 and a power of 80% using a 2-sided t test. The actual detectable difference is most likely closer to 150 kcal with a sample size of 700 because complex sample designs tend to increase variation.

We used list-assisted random-digit dialing (24) to obtain a sample of 10,000 telephone households across the United States. This sample was then divided into one main sample of 6,000 telephone numbers and one reserve sample of 4,000 telephone numbers. Only the sample of 6,000 numbers was needed to obtain the required 700 completed 24-hour dietary recalls. As in the 1994-1996 CSFII, a minimum of 10% of all 24-hour dietary recalls was conducted on each day of the week, including weekend days, providing a fairly even distribution by day of the week.

Interviewer Training

Twenty-one telephone interviewers were trained for this study. A 1-day training session was held for the 12 experienced interviewers assigned to conduct the screener interviews. A 2-day training session was held for the 9 interviewers experienced in dietary data collection who were assigned to collect the 24-hour dietary recall. Trained supervisors, including a staff nutritionist, monitored interviews, provided regular feedback to the interviewers, and answered questions as they arose. All telephone interviews and training were conducted by Westat, Inc, staff at the Telephone Research Center in Rockville, Md.

Table 1
Comparison of weighted distributions of sampled persons for selected characteristics, by study

Characteristic	Telephone recalls		1994-1996[a] CSFII	
	Unweighted sample size (N=700)	Weighted %[b]	Unweighted sample size (N=550)	Weighted %[c]
Metropolitan status				
Metropolitan	537	80.3	438	82.1
Nonmetropolitan	163	19.7	112	17.9
Census region				
Northwest	119	19.8	98	19.4
Midwest	176	23.3	115	19.5
South	258	35.1	198	35.4
West	147	21.8	139	25.8
Educational attainment				
High school graduate or less	252	44.9	237	40.2
Some college, no 4-yr degree	241	31.8	149	28.4
Bachelor's degree or more	207	23.3	164	31.4
Employed last week				
No	147	29.3	170	30.4
Yes	553	70.7	380	69.6
Black/African origin				
No	620	86.4	501	92.1
Yes	80	13.6	49	7.9
Hispanic origin				
No	645	89.7	477	87.1
Yes	55	10.3	73	12.9

[a]CSFII=1994-1996 Continuing Survey of Food Intakes by Individuals (3).
[b]Percent calculated on total weights calibrated to Current Population Survey (27).
[c]Percent calculated on total final weights from 1994-1996 CSFII.

Food Instruction Booklet

To probe for additional information about foods reported by respondents, the interviewers used a food instruction booklet (25) containing standardized questions specific to various foods in the collection of the 24-hour dietary recall. A few modifications were made to the 1994-1996 CSFII Food Instruction Booklet to reduce respondent burden in the telephone survey. Specifically, questions about ingredients within recipes were deleted if their responses had not made a notable difference to mean nutrient intakes in the 1994-1996 CSFII, or if the information obtained was not useful to the coding process. For example, probing for the type of milk (whole, low-fat, or skim) in homemade puddings was eliminated, and a composite reflecting typical nutrients for whole, 1%, 2%, and skim milk was used in the analysis.

Data Collection Procedures

The screener questionnaire contained 16 questions designed to collect information about the household that allowed the interviewer to determine if the household contained an eligible respondent. For weighting purposes the screener also col-

Table 2
Comparison of mean nutrients derived from the Telephone Feasibility Study and the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) pooled sample

Nutrient	Telephone study (n=700)	CSFII 1994-1996 (n=550)	*P* value[a]
	← *estimated mean* →		
Number of foods recorded	14.9	13.8	.002[a]
Food energy (kcal)	1,854	1,731	.027[a]
Protein (g)	70.0	64.7	.026[a]
Total fat (g)	67.4	63.0	.095
Saturated fat (g)	22.5	21.1	.124
Cholesterol (mg)	221	214	.502
Carbohydrate (g)	242.3	223.0	.011[a]
Dietary fiber (g)	14.6	13.9	.280
Vitamin C (mg)	103	90	.116
Vitamin B-6 (mg)	1.65	1.50	.027[a]
Folate (μg)	242	232	.410
Calcium (mg)	765	664	.002[a]
Iron (mg)	14.6	13.4	.050

[a]*P* value associated with a test of the hypothesis that the mean intake from the Telephone Feasibility Study is equal to the corresponding mean intake from the 3-year CSFII. $P<.05$ indicates that the means are significantly different at the 5% significance level. No adjustments have been made in the tests for multiple simultaneous comparisons. With a large number of comparisons, there is an increased possibility of incorrectly detecting at least one significant difference by chance alone, which exceeds the experimentwise error rate of 5%.

lected demographic data, including the respondent's education level and ethnicity.

Within the sampled household, one woman aged 20 to 49 years was selected. In households with more than one eligible person, the woman with the most recent birthday was asked to participate. If she agreed, a letter for informed consent and a set of measurement aids were sent to her the next business day by express delivery. The measuring aids included a 19-page 2-dimensional food model booklet, a plastic set of 4 measuring cups and 4 measuring spoons, and a 12-inch ruler. Although not used in the 1994-1996 CSFII, the booklet of 2-dimensional models was included to help respondents estimate food quantities without an in-person interviewer. The models were from a set distributed by the University of Texas-Houston School of Public Health as part of the Food Intake Analysis System (version 3.0, 1996, University of Texas-Houston School of Public Health). They were selected for their compatibility with Survey Net, a customized computer-assisted food coding and data management system developed by the Agricultural Research Service for use in the CSFII (3).

The 24-hour dietary recall data were collected by telephone interview after materials were sent to the home. The exact day of the 24-hour dietary recall was unknown to the respondents. The median number of days between sending the materials and conducting the interview was 9 days (range=1 to 53 days). The CSFII multiple-pass method was used to elicit a report of all food and beverages consumed from midnight to midnight the day before the interview. This procedure first has respondents provide a list of all foods eaten the previous day, using any recall strategy. Interviewers then obtain a more detailed list by probing for additions to foods and giving respondents an opportunity to recall food items initially forgotten. In the third pass, the interviewers review the list of foods reported with the respondent to try to elicit reports of more foods and eating occasions (23). Measuring guides were used in collecting the 24-hour dietary recalls to help the respondents estimate the quantities of the foods and beverages consumed, similar to the method described by Posner et al (17).

The 24-hour dietary recall was followed by a series of health-related questions, including the respondent's exercise habits, height, and weight. The final questions were socioeconomic, including employment status, food stamp use, home ownership, and the presence of children in the household.

Data Processing

Completed intake questionnaires received a quality review to determine whether they met the minimum criteria for completeness: (a) individual foods were remembered for each eating occasion, (b) descriptive details were given for at least 75% of all foods reported, and (c) quantities were given for at least 85% of all foods reported. Food coders coded the food-related items from the 24-hour dietary recalls using Survey Net. Nutrient analyses were conducted using the same nutrient database as the 1994-1996 CSFII (1996, Survey Nutrient Database for 1994-1996 CSFII, US Dept of Agriculture, Agricultural Research Service, Riverdale, Md). Other nonfood data from the intake questionnaire and the screener questionnaire were coded, key entered, and machine edited by one data processing staff member.

STATISTICAL ANALYSES

Sample weights were incorporated into the analysis to compensate for varying selection probabilities, differing response rates, and potential sampling deficiencies. Sources of varying selection probabilities include the varying number of eligible women and number of residential telephones in a household. Differing response rates result when certain subgroups are under- or overrepresented. Potential sampling deficiencies occur when certain populations are undersampled or not sampled at all, such as households without telephones. The last step of sample weighting, a multistep procedure, was to calibrate the sample to be similar to a known population.

Each household was assigned a weight, which was the inverse of the probability of selection. This weight was then adjusted for residential status, eligibility status, and nonparticipation. The weight assigned to each subject was the household weight adjusted for the number of eligible women and the number of residential telephone lines in the home. Next, this weight was adjusted for nonresponse to the 24-hour dietary recall and calibrated to the 1994-1996 Current Population Survey (26) according to the same demographic groups used to calibrate the CSFII. Although the actual distributions between this study and the CSFII differ somewhat, as seen in Table 1, the weighted distributions from the 2 samples were similar after calibration to Current Population Survey control totals. The weighting procedures for this feasibility study were comparable to those used in the 1994-1996 CSFII.

Standard errors of estimates were computed using a jackknife replication method, which involved randomly generating a large number of subsamples from the entire data set and calculating estimates for each subsample (27). The standard error for the estimate for the entire data set is calculated from the variation in the subsample estimates (28). Using the calibrated weights and jackknifed standard errors, approximate *t* tests were constructed to examine differences in averages between the 2 groups. Comparisons of respondents and nonrespondents were performed using χ^2 tests on unweighted counts. *P* values less than .05 were deemed statistically significant. *P* values were 2-sided and not adjusted for multiple comparisons. It should be noted that with the large number of

comparisons, there is an increased possibility of statistical differences by chance alone that exceeds the nominal 5% level. This means that sample means found to be statistically significantly different from each other were less likely the result of true differences and more attributable to chance than if adjustments for multiple comparisons had been made.

RESULTS

Response Rates

Of the 6,000 initial telephone numbers, 871 were determined to be nonresidential/nonworking before data collection began; 1,813 were determined to be nonresidential/nonworking during data collection, and no one answered at 551. Of the remaining 2,765 working residential telephone numbers, 996 households identified had an eligible woman and 783 of those women agreed to participate. Seven hundred women completed the 24-hour dietary recall. Thus, of the households contacted by telephone who had an eligible female resident, 70% completed a 24-hour diet recall.

Nonrespondents were of 2 types of eligible women: screener nonrespondents were 213 women who did not complete the screener interview or did not agree to participate, therefore very little demographic data were available; and intake nonrespondents were 83 women who completed the screener interview, but who did not complete the 24-hour dietary recall for any reason. A significantly higher percentage of the intake nonrespondents resided in metropolitan statistical areas compared with the respondents (89.2% vs 76.7%, $P=.01$). Nonrespondents tended to be somewhat younger than the respondents ($P=.07$), with 36.1% in the 20- to 29-year-old age group compared with 24.4%. Nonrespondents had lower educational attainment than the respondents ($P=.01$) with 7.2% and 4.4%, respectively, having less than a high school education and 31.6% and 42.2%, respectively, having a high school education or equivalent. There were no significant racial differences.

Telephone vs CSFII Data

Table 2 compares estimates of mean nutrient intakes from the telephone study sample with the corresponding mean estimates from 1994 to 1996 CSFII in-person interviews. The telephone survey yielded consistently greater mean intake per respondent than the combined CSFII in-person sample in number of foods, total food energy, total protein, carbohydrate, vitamin B-6, and calcium.

Mean intakes for 33 food groups and subgroups were also compared with 1994-1996 CSFII reported intake. Selected results are depicted in Table 3. The results of the food-group data are less striking than nutrient intake with generally no significant differences between the Telephone Feasibility Study estimates and the CSFII estimates for the items shown. Exceptions to this include the reported mean intake (in grams) for tomatoes and nonalcoholic beverages (particularly low-energy carbonated soft drinks) (not shown in the Table). These were higher in our telephone survey. Similar comparisons for mean portions of 54 food items were made (not shown in Tables). Most foods selected for this comparison were from a list of the 200 foods providing the most energy to this gender/age group according to the CSFII. A few foods were added to the comparison that were lower in energy if they were frequently consumed in the 1994-1996 CSFII, for example, sugar-free cola-type soft drinks. Only the average portion sizes for reports of salad lettuce, white sugar, raw tomatoes and bananas, low-fat milk, dry mix macaroni and cheese, and some soft drinks differed between survey methods; all were greater in the telephone survey except raw bananas.

Table 3
Comparison of selected mean food intakes (in grams) derived from the Telephone Feasibility Study and the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) pooled sample

Food group	Telephone study (n=700) Estimated mean	CSFII 1994-1996 (n=550) Estimated mean	P[a]
Total grain products	300	282	.255
Total vegetables	190	173	.192
White potatoes	55	48	.169
Fried potatoes	21	20	.877
Tomatoes	32	21	.012[a]
Legumes	18	22	.448
Total fruits	165	138	.178
Citrus fruits and juices	100	69	.088
Other fruits and juices	63	68	.480
Total milk and milk products	237	200	.055
Total meat, poultry, and fish	185	164	.089
Eggs	15	16	.679
Total fats and oils	17	15	.124
Total sugars and sweets	25	21	.365
Total beverages	1,080	969	.059
Total nonalcoholic beverages	1,026	892	.022[a]

[a]*P* value associated with a test of the hypothesis that the mean intake from the Telephone Feasibility Study is equal to the corresponding mean intake from the 3-year CSFII. $P<.05$ indicates that the means are significantly different at the 5% significance level. No adjustments have been made in the tests for multiple simultaneous comparisons. With a large number of comparisons, there is an increased possibility of incorrectly detecting at least one significant difference by chance alone, which exceeds the experimentwise error rate of 5%.

Telephone Feasibility vs CSFII Data, by Survey Year

Table 4 compares estimates of mean nutrient intakes of the telephone survey sample with the corresponding estimates based on 1 day of intake from in-person interviews in the 1994-1996 CSFII, by sample year. Mean intakes reported by CSFII respondents in this gender/age group during the months of January through March generally increased from 1994 to 1996. Reported intakes of most nutrients in the telephone survey were significantly higher than those reported in the 1994 and 1995 CSFII surveys. On the other hand, there are no significant differences between the telephone survey results and the 1996 CSFII results. Similar results were found when comparing the mean food intake of the telephone survey to 1994, 1995, and 1996 survey results. There was a general upward trend of intake of most foods from 1994 to 1996. There were few statistically significant differences between the 1996 CSFII results and our telephone survey, except that lower mean intakes per respondent for total meat, poultry, and fish; tea; and low-energy carbonated soft drinks were reported in the 1996 CSFII.

DISCUSSION

The first goal of the Telephone Feasibility Study was to determine whether collecting food consumption data over the telephone was indeed feasible. Our results confirm that it is feasible to collect detailed food intake data over the telephone

Table 4
Comparison of mean nutrient intakes derived from the Telephone Feasibility Study and the comparable subsample of Continuing Survey of Food Intakes by Individuals (CSFII 1994-1996), day 1, by sample year

Nutrient	Telephone Feasibility Study (n=700) Estimated mean	CSFII 1994 (n=210) Estimated mean	CSFII 1994 (n=210) P[a] value	CSFII 1995 (n=177) Estimated mean	CSFII 1995 (n=177) P value	CSFII 1996 (n=163) Estimated mean	CSFII 1996 (n=163) P value
Number of foods recorded	14.9	13.1	.001[a]	13.8	.012[a]	14.5	.542
Food energy (kcal)	1,854	1,644	.004[a]	1,691	.032[a]	1,857	.971
Protein (g)	70.0	61.3	.007[a]	66.8	.286	66.1	.217
Total fat (g)	67.4	57.8	.001[a]	63.7	.356	67.4	1.00
Saturated fat (g)	22.5	19.8	.008[a]	21.1	.333	22.2	.839
Cholesterol (mg)	221	203	.168	220	.948	220	.953
Carbohydrate (g)	242.3	214.3	.006[a]	210.1	.001[a]	245.1	.806
Dietary fiber (g)	14.6	12.7	.027[a]	13.3	.084	15.6	.331
Vitamin C (mg)	103	82	.018[a]	82	.014[a]	108	.725
Vitamin B-6 (mg)	1.65	1.39	.010[a]	1.53	.170	1.57	.369
Folate (μg)	242	218	.160	216	.088	261	.287
Calcium (mg)	765	643	.002[a]	658	.024[a]	691	.082
Iron (mg)	14.6	12.4	.013[a]	12.7	.019[a]	15.0	.622

[a]*P* value associated with a test of the hypothesis that the mean intake from the Telephone Feasibility Study is equal to the corresponding mean intake from the 3-year CSFII. $P<.05$ indicates that the means are significantly different at the 5% significance level. No adjustments have been made in the tests for multiple simultaneous comparisons. With a large number of comparisons, there is an increased possibility of incorrectly detecting at least one significant difference by chance alone which exceeds the experimentwise error rate of 5%.

using procedures and instruments similar to those used for the 1994-1996 CSFII. The second goal of the telephone study was to compare the responses from the telephone survey with those of a comparable pooled subsample from the 1994-1996 CSFII. Our results were generally higher than the CSFII results in all major nutrients, although there were few significant differences in types of foods. The CSFII subsample used for comparison demonstrated an upward trend in mean nutrient and food intake between 1994 and 1996. Interestingly, there were no significant differences in mean intakes of major nutrients between the telephone survey results and the CSFII 1996 results. Mean intakes of only 4 foods—skim milk; total meat, poultry, and fish; tea; and low-energy carbonated beverages—were significantly higher in the Telephone Feasibility Study.

Our results are consistent with the studies of Posner et al (n=204) (6), Dubois et al (n=159) (12), Krantzler et al (n=107) (14), and Galasso et al (n=49) (13), all of whom found that telephone-administered 24-hour dietary recall was a valid method to obtain dietary information. Another study examined 9 different methods to obtain dietary information (n=154 per group) including in-person interview, telephone, mail, and several combinations of those methods (16). Results of that study indicated that use of the telephone for dietary recalls provided comparable data to other methods with less effort and cost involved. Lyu et al (15) found similar results in the use of the telephone vs face-to-face methods of obtaining food frequency in a sample of different ethnic and gender groups. Our report includes the largest sample reported to date.

Underreporting of food intake assessed by 24-hour recall is noted in several studies as a potential problem (1,2,29-31). Buzzard (29) reports that the use of probing techniques by a skilled interviewer can considerably reduce the amount of underreporting. Our interviewers used similar probing techniques. A few studies have found that women have less variability in their energy intake than men (30-32). Dietary recall data from the 35- to 44-year-old age group have been reported to be the most valid (31). Because sample and methods of both the Telephone Feasibility Study and the 1994-1996 CSFII were equivalent, except for the use of the telephone in the feasibility study, the higher reporting of nutrients in the telephone study may not be the result of methodologic differences.

The Telephone Feasibility Study was designed to be as similar as possible to CSFII, except for the use of telephone interviewing. However, it is important to note that the results are potentially confounded with the following differences in timing and sampling. First, CSFII was conducted during 1994 to 1996 whereas the Telephone Feasibility interviewing was done in 1998. This time difference may be of importance as data from the 1994-1996 CSFII compared with earlier CSFII surveys show that total energy intake was about 6% higher in 1994 than in 1980 (33). Similar results were noted by Posner et al (6) who found an "upward shift in the intake distributions due to changes in nutrient intake over the time period from 1973 to 1980" (p 549). These data suggest that Americans' diets are changing in content and variety. Data from our Telephone Feasibility Study may support such a trend over time. Second, the sample for the Telephone Feasibility Study contained only persons who had telephones and agreed to be interviewed, whereas the subsample from the 1994-1996 CSFII included both telephone and nontelephone households. This factor may not be a significant problem because 97% of US households own telephones (18). Ford (34) has reported a difference in some demographic characteristics and reported nutrient intakes on 24-hour diet recalls between national survey participants with and without a telephone. Survey participants without a telephone consumed less carotene and vitamins A, C, and E than persons with a telephone. Nontelephone respondents were more likely to be younger, nonwhite, less educated, and poorer. Still, other demographic data (metropolitan statistical area, census region, ethnicity, home ownership) were quite similar between our telephone survey and CSFII samples, which also minimizes the potential effect of

nontelephone households on our results. Weighting adjustments were made to compensate for nonresponse, but such adjustments may not fully eliminate the potential bias associated with sample nonresponse (35). Finally, the Telephone Feasibility Study sample contained only interviewed women between the ages of 20 and 49 years, and thus our results cannot be generalized to the entire US population.

APPLICATIONS

- We conclude that the use of the telephone is a practical, feasible, and valid method for collecting 24-hour dietary recall data in national food consumption surveys.
- Efficacy of the telephone method may have been increased by the use of the multiple-pass approach and 2-dimensional visuals to collect the 24-hour dietary recall.
- Underreporting may have been less of a problem with the telephone survey because greater amounts of major nutrients were reported than the pooled 1994-1996 CSFII survey.
- There were few differences between the current telephone study and the 1996 CSFII. This is an important finding because nutrition policy and health and nutrition intervention plans are based on the results of these national studies.
- Use of telephone interviews for large-scale studies may decrease costs by as much as 75% (11,18,36) and increase access to remote and unsafe locales (15).
- Further research is needed to determine whether the higher nutrient intake reported in our study was a result of a secular trend or a methodologic difference between telephone and in-person interviews.

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